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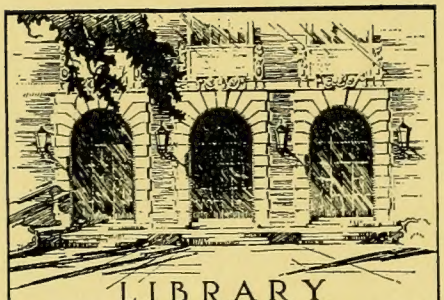

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WILDLIFE AND FISHERY VALUES OF BOTTOMLAND LAKES IN ILLINOIS

Frank C. Bellrose
and
Clair T. Rollings

Printed by Authority of the State of Illinois

NATURAL HISTORY SURVEY
Harlow B. Mills, Chief

Biological Notes No. 21 Urbana, Illinois June, 1949

Fig. 1.--Typical Illinois River levee. Part of the Illinois River is visible at right and margin of a drained lake basin, planted to corn, at left. In background at left is pumping station.

Fig. 2.--Pumping station of levee district bordering the Illinois River. Levee shown in fig. 1 is in background. Surplus water is pumped into the river on the other side of levee to prevent inundation of drained lake basin by seepage or precipitation.

WILDLIFE AND FISHERY VALUES OF BOTTOMLAND LAKES IN ILLINOIS

Frank C. Bellrose
and
Clair T. Rollings*

Along the Illinois and Mississippi rivers in Illinois are numerous bottomland areas, formerly lakes and marshes, that have been leveed and drained for agriculture, figs. 1, 2, and 3. In the past two decades it has been a matter of public policy to maintain these lands for agriculture, even though this policy required the expenditure of large sums of public money in attempts

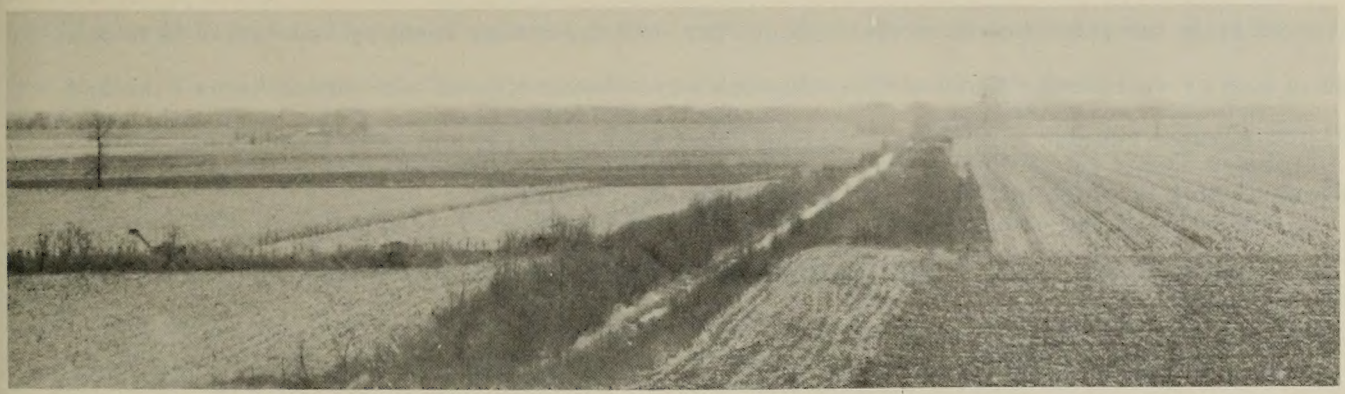

Fig. 3.--View from bluff that overlooks drained lake basin bordering the Illinois River. A drainage ditch is visible near center of picture. In the background is a levee. Water is pumped from drainage ditches into the river.

to prevent flooding of the areas. Raising and improving levees, blocking off about half of the flood plain of the Illinois River valley, have resulted in increasing flood heights (Bellrose 1945) and causing greater damage than previously to cities and towns and unleveed lands in the valley.

On levees protecting about 190,000 acres of agricultural land in the Illinois River valley, the state of Illinois spent $1,317,171 ($6.93 per acre) in 1926-1927 and the Corps of Engineers, Department of the Army, $5,405,494 ($28.45 per acre) from that time to 1946. In 1946, the Corps of Engineers' flood control report on the Illinois River Basin outlined additional levee improvements that would total almost $15,000,000 ($78.95 per acre) at 1940 construction costs.

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Many groups of Illinois citizens interested in conservation, agriculture, and civic affairs have questioned the wisdom of spending huge public sums to maintain agriculture in river bottomlands. For years, conservation groups have pointed to the recreational value of these lands in the natural state. And, although there has been a general awareness of the money brought into river towns by commercial fishermen, trappers, duck hunters, and sport fishermen, there have been, unfortunately, few if any figures readily available to support the popular impressions of the amounts of money involved.

To provide sorely needed information on the matter, we have compiled figures on the harvest of commercial fish, sport fish, ducks, and fur per acre of bottomland area; the money received from the sale of commercial fish and fur; and the money spent by sportsmen to take a unit of fish or waterfowl. Many of these figures were obtained from two United States Fish and Wildlife Service refuges in Illinois -- Spring Lake, near Savanna, and Lake Chautauqua, near Havana -- both of which had once been drained and then restored.

METHOD OF ASSESSING VALUES

Each area of wild land or water used by man has multiple values. If private, it has tangible values to the owner and also to the public with which the owner does business. Also, it has intangible values to the owner and, where used by other persons, to the public.

Tangible values to the owner can be measured by the annual income from the harvest of commercial products -- fish, fur, timber -- and the selling of hunting and fishing privileges. But how can tangible values to the public, or intangible values to either owner or public, be measured?

Public Values:--It is the desire for recreation, not food, that draws multitudes of anglers to streams, ponds, and lakes, and hunters to marshes, fields, and woodlands. Because of their interest in hunting and fishing, sportsmen spend millions of dollars each year for equipment, transportation, guides, special facilities, lodging, and many other sundries. The production and distribution of the equipment and the provision of facilities used in hunting and fishing bring employment to many thousands of workers.

The dollar is the criterion we recognize best and have used to determine the economic importance to the public of baseball, football, skiing, tennis, golf, and other sports. It is reasonable to determine the tangible value to the public of hunting or fishing on a similar basis--by cal-

culating the amount of money the public spends in pursuit of the sport, in this case in harvesting the various units of game or fish. The tangible cost of a sport is indicative of its intangible value. The money spent by the public to hunt and fish is a good measure of the public desire for hunting and fishing, just as the money spent for the man-made sports is a good measure of the public desire for these recreational activities.

Items that we have considered valid in assessing the public values of hunting and fishing are those that most business firms and state and federal governments would recognize as legitimate expenses: cost of transportation, lodging, and meals; depreciation on gun and fishing tackle; cost of ammunition and bait; rent of or depreciation on boat and motor; lease or purchase of hunting and fishing privileges on private areas; guide fees and license fees. Probably few individuals would have all the expenses listed above, but all would have some.

Private Values.--Not so high, of course, as public fishing and hunting values are private values: money accruing to the owner of private lands for providing hunting and fishing facilities and harvesting commercial fish and fur. Over a long period of years, many private lands used for agriculture would be more profitable to the owner if restored or converted to one or more kinds of wild lands (Hewitt 1942, Bellrose 1945, Penfound & Schneidau 1945).

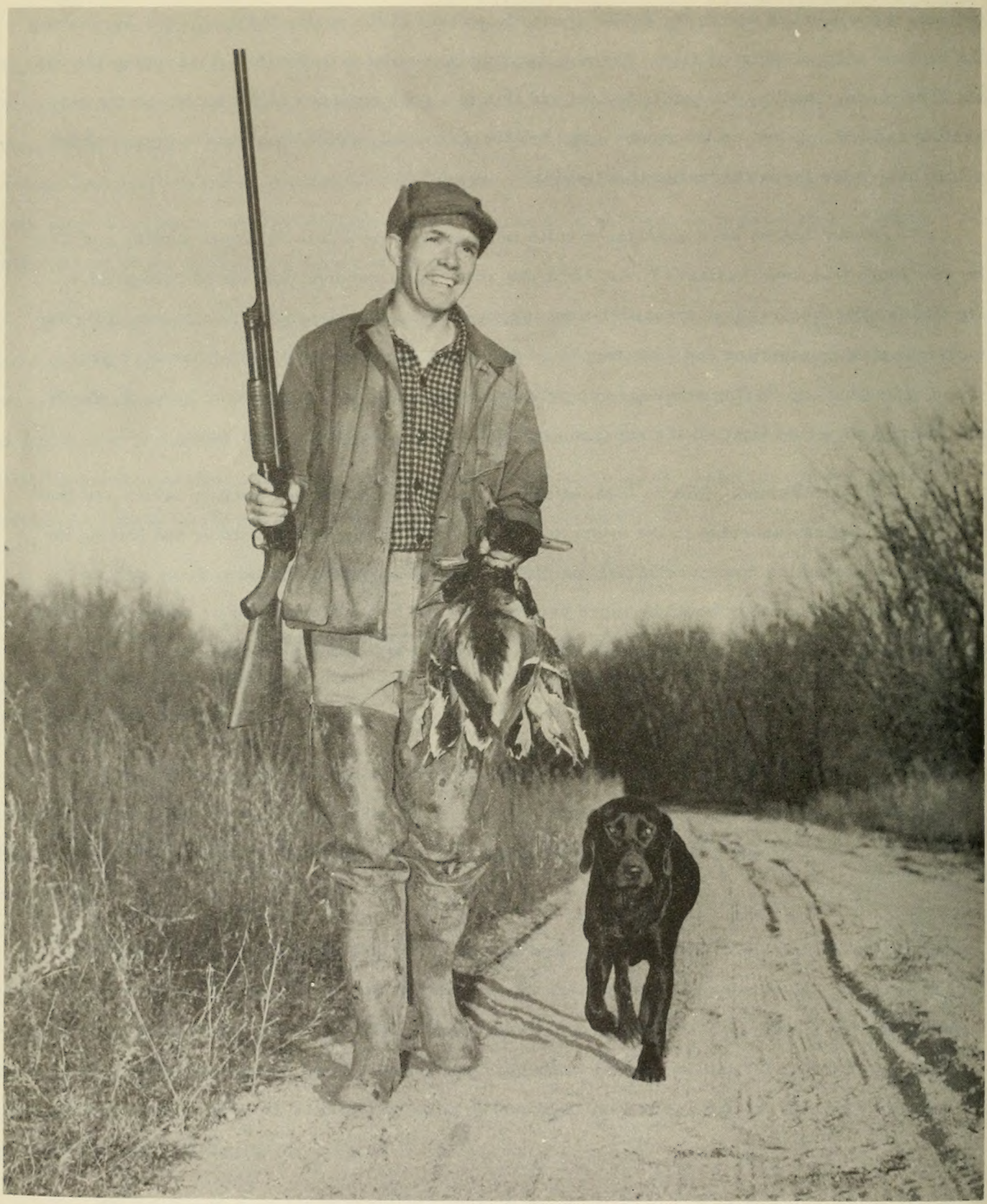

Fig. 4.--In recent years, Illinois hunters have spent an average of about $7.25 for each duck they killed and bagged.

WATERFOWL VALUES TO PUBLIC

Probably the greatest value of the backwater lakes of the Illinois and Mississippi river valleys lies in duck hunting, fig. 4. About 80 per cent of the ducks killed and bagged in Illinois have been taken in these valleys (Bellrose 1947). Shooting pressure is great in Illinois during the 1946 season, 93,387 federal "duck stamps" were sold in the state. The number of hunter-days per acre at public shooting grounds has ranged from 0.47 to 1.80, table 1. The competition for waterfowl hunting grounds is so great that in recent years some tracts have sold for over $100 an acre solely for hunting.

It is doubtful if the addition of a large number of shooting grounds would reduce the hunting pressure per acre. "In a state of over 7,000,000 people with over 300,000 hunters -- the majority of whom are within a few hours drive of most of the waterfowl grounds -- the addition of new areas would probably result in more non-hunters trying their hand at duck shooting, in more upland shooters turning to waterfowl and in a large portion of the present free-lance waterfowlers hunting more frequently" (Bellrose 1944).

With similar quality of habitat and management, areas south of Bureau in the Illinois River valley and south of Rock Island in the Mississippi River valley are of comparable value for duck hunting. Migration routes followed by a large proportion of Illinois mallards and lesser scaups enter the two valleys below Bureau and Rock Island. Consequently the bottomland lakes above these two cities are not so valuable per unit of comparable habitat as those below.

Qualitative factors affecting the value of an area for waterfowl hunting are (1) abundance of natural foods; (2) proximity to an undisturbed area, that is, refuge or rest grounds; (3) size; (4) cover; (5) density of hunters; (6) depth of water.

Public shooting areas in the Illinois River valley illustrate a mixture of these quality factors very well, table 1. When quality of habitat of the two types of shooting areas are similar, public grounds yield a greater waterfowl bag per acre (1.68 ducks) than private clubs (1.48 ducks), because they accommodate more hunters who produce greater fire power, table 1.

Having determined the waterfowl bag on the typical bottomland lake in the Illinois River valley as used by public and private hunting groups, we next need to determine the expenditures made in hunting waterfowl. Table 2 reveals the cost of figures as determined from

Table 1.--Average number of ducks killed and bagged per acre on public shooting grounds and at private clubs, Illinois River valley.

Area	Number of Acres	Hunters Per Year	Hunters Per Acre Per Year	Ducks Killed and Bagged Per Acre Per Year								Average Annual Duck Bag Per Acre
				1940	1941	1942	1943	1944	1945	1946	1947	
Sparland Public Shooting Ground.....	873-1,280[a]	1,035	1.18-0.81	2.00	1.97	3.59	?	2.07	?	?	0.37	2.00
Woodford County Public Sporting Ground..	1,781-2,450[b]	1,160	0.64-0.47	0.53	0.34	0.84	?	?	?	?	0.37	0.52
Spring Lake (Tazewell County)...	835	956	1.80	1.70	2.27	2.62	1.39	1.63	?	?	1.40	1.83
Liverpool Grounds.....	1,900-2,100[c]	2,603	1.37-1.24	1.80	2.05	3.27	1.73	4.13	3.16	1.10	1.11	2.29
Rice Lake Wildlife Area.....	1,034-1,167[d]	1,075	1.04-0.92	1.68	3.77	1.65	?	1.43	1.30	?	0.80	1.77
Average.....	----	---	--------	1.54	2.08	2.39	1.56	2.31	2.23	1.10	0.81	1.68
Private Clubs.....	45,000-60,000	12,850	0.24	1.48	1.49	1.46	--	--	--	--	---	1.48

[a] 407 acres added by purchase, 1946.

[b] 669 acres added by purchase, 1947.

[c] Actually only 800-1,000 acres, depending on water stage, but kill increased because area is adjacent to Chautauqua National Wildlife Refuge; so in calculations one-third of refuge acreage was added to shooting-ground acreage.

[d] Private club area prior to 1943; purchased by state in that year; 133 acres added in 1945.

Table 2.--Average daily expense per duck hunter in Illinois; figures are based on 77 interviews, 1947.

Type of Hunting	Number of Hunters	Transportation Cost	Lodging Cost	Meal Cost	Shell Cost	License Fees	Boat Rental or Depreciation	Club or Guide Fee	Investment Depreciation			Total Cost Per Day	Ducks Per Hunter Per Day	Cost Per Duck
									Gun	Clothes, Boots	Decoys			
Public...	41	$5.46	$0.62	$2.58	$0.67	$0.40	$1.00	-	$0.30	$1.31	$0.75	$13.09	1.34	$9.77
Club.....	36	3.44	0.53	2.56	0.88	0.40	1.00	7.33	0.28	2.45	2.12	20.99	2.17	9.67
Average	77	4.52	0.58	2.57	0.77	0.40	1.00	3.43	0.29	1.85	1.32	16.73	1.72	9.73

interviews during the 1947 season with 77 hunters: 41 free-lance and 36 club hunters. Explanation of the cost items follows.

Transportation expense was figured on the basis of $0.03 per mile; of the 77 duck hunters we interviewed, those at public shooting grounds drove an average of 182 miles per day of hunting and those at private clubs 115 miles; both groups together averaged 151 miles. A larger sample of duck hunters and the number of miles they traveled was obtained from a report by Lueth (1946) on hunting at the Rice Lake Wildlife Area in 1945. Lueth listed the hunters only by their home counties. Using Lueth's report, we calculated mileage for each hunter on the basis of the distance from Rice Lake to the largest city in his county. We determined that the average Rice Lake hunter made a round trip of 151 miles which is, coincidentally, the average mileage of the 77 hunters we interviewed in 1947.

Only 21 of the 77 hunters we interviewed had lodging expense. This totaled $89.45, but, since most hunters staying overnight hunted two days, we charged half of $44.73 lodging expense against each day of duck hunting by the 77 hunters. Meal cost, about the same for public and club hunters, amounted to $2.57 per hunter per day. Each public hunter averaged 8.4 shells per day totaling, at $0.08 a shell, $0.67, and each club hunter, 11 shells, totaling $0.88 per day.

A resident hunting license in Illinois costs $2.00, but, since many waterfowlers also hunt upland game, only $1.00 of this sum was charged against duck hunting. To this amount was added $1.00 for the federal "duck stamp" required of all hunters over 16 years of age. Although the shooting club hunter in Illinois as a whole averages only 3.5 days of duck shooting per year (Bellrose 1947), this type of hunter in some areas of the state averages as much as 6.0 days of shooting per year (Arthur 1948). To be conservative in our depreciation of equipment, we used 5 days of duck hunting per year in prorating annual charges. Shooting-club and daily-fee hunters who were questioned averaged $7.33 per hunter-day for club dues or for rent of blind; this expense would, of course, not apply to public-shooting-grounds hunters. Boat rental or depreciation was estimated to be $1.00 per day of use.

Other expenses are of a capital investment type. The average shotgun used by the 77 hunters questioned cost $95. Shotguns were depreciated at the rate of 3 per cent a year in a study by Gordon (1941). We used $1\frac{1}{2}$ per cent in our calculations, assuming that a duck hunter divides use of his shotgun equally between waterfowl and upland game. Our calculated depreciation on shotgun amounted to $1.42 a season or $0.29 a hunting day. Investment in hunting clothes

and boats averaged $46.20 per hunter. When this equipment was depreciated over a 5-year period, the cost was calculated to be $9.24 a year, or $1.85 per hunting day. Investment in decoys was $33.00 a hunter, which, with an allowance for painting and depreciation, would amount to $6.60 per year or $1.32 per hunting day.

The cost items totaled $13.36 per day for the 41 public-shooting-grounds hunters interviewed, or, on the basis of 1.34 ducks killed and bagged per day, $9.97 per duck. The average bag per day by these hunters is very close to the 1.45 ducks per hunter-day at Illinois public shooting grounds in 1940-1942, as reported in a previous study (Bellrose 1944).

Although cost items were higher per day of duck hunting for members of private shooting clubs and for daily-fee shooters, their cost per duck, $9.67, was slightly lower because of their greater success.

A questionnaire sent out to shooting-club hunters in 1939 and answered by 127 of them disclosed that the minimum average expenditure per duck killed and bagged was $4.77 for that season. An approximate mid-point in the cost per duck between 1939 and 1947 has been established as $7.25. This figure has been used in the present study in calculating the value of duck-hunting land.

When the average bag per acre at public shooting grounds, table 1, is 1.68 ducks and the average cost of bagging a duck is $7.25, the economic value to the public of a bottomland lake or marsh for public hunting is calculated to be $12.18 per acre-year. When the average bag per acre at private shooting clubs is 1.48 ducks, and the average cost of bagging a duck is $7.25, the value of bottomland for such clubs is $10.73 per acre-year.

ANGLING VALUES TO PUBLIC

Angling is a recreation for which 574,784 Illinois residents bought licenses in 1947. Sport fishing is especially popular on 11 Illinois River valley lakes that comprise 25,000 acres of the 75,000 acres of water in the valley. The greater popularity of certain lakes for angling is related to fishing success there and to their accessibility to fishermen. Factors contributing to fishing success are transparency and depth of water, amount of shore line per acre of water, and composition of the fish population. Some lakes are difficult of access because of private ownership or poor roads.

Sport fishing data for Illinois River valley lakes were gathered largely from Lake Chautauqua, a former agricultural levee district and now a national wildlife refuge. Although

this lake is one of the more popular fishing areas, seven other lakes are known to be more intensively used and are reputedly better fishing lakes. Angling data from Lake Chautauqua may, therefore, be regarded as representative of those in the Illinois River valley. Because catches

Table 3.--Number of pounds of fish taken by anglers, pounds of fish caught per acre, and recreational value of the catch from 3,200 acres of water in Chautauqua National Wildlife Refuge, 1941-1943 and 1945-1947.*

Kind of Fish	Pounds Per Acre						Yearly Average, Pounds Per Acre	Recreational Values	
	1941	1942	1943	1945	1946	1947		Per Pound	Per Acre
Bass.....	0.69	0.48	0.17	0.23	0.37	0.11	0.34	$2.50	$0.85
Others.....	2.83	2.61	1.85	1.74	1.04	2.37	2.07	0.75	1.55
Total.....	3.52	3.09	2.02	1.97	1.41	2.48	2.41	----	$2.40

*The figures do not represent the full extent of the anglers' catch, as the fish caught from private boats are unrecorded; only the fish caught by anglers renting equipment from boat liveries are recorded.

are recorded only by boat livery operators, those made from private boats are unrecorded; thus, the figures in table 3 do not represent the full extent of the anglers' catch.

The public recreational value assigned per pound of largemouth bass was $2.50 and for other fish, most of them pan varieties, $0.75 per pound. These figures are based upon the

Table 4.--Number of man-days of fishing, pounds of fish caught per acre, and recreational value of the catch at 3,500-acre Spring Lake, near Savanna, 1946-1947.

Year	Number of Man-Days	Pounds Per Acre	Recreational Value	
			Per Pound	Per Acre
1946.....	28,000	61.3	$0.33	$20.23
1947.....	38,000	57.8	0.50	28.90
Average..	33,000	59.5	$0.415	$24.56

amount of money fishermen spent per day in making their catch, and were derived in a manner similar to the method used in determining the value of waterfowl. Although the fish-value figures were established by Dr. George W. Bennett and other aquatic biologists of the Illinois Natural History Survey several years before the Manual of Instructions, River Basin Studies, was issued by the United States Fish and Wildlife Service, it is interesting to note the close approach to the designated values of $2.00 per pound for bass and $0.75 per pound for pan fish now being used by the federal agency in river basin analyses.

Over a period of years, table 3, Lake Chautauqua had an annual angling value to the public of $2.40 per acre of water.

Spring Lake, an abandoned agricultural levee district along the Mississippi River near Savanna, Illinois, has provided exceptionally good fishing for bullheads. Although not a favorite sport fish, bullheads are sought by cane-pole fishermen who use worms for bait. The number of fish, almost all black bullheads, taken at Spring Lake in 1946 and 1947 is available through the efforts of the Brown Brothers Boat Livery; Clair T. Rollings, refuge manager in 1946; and Harry L. Adams, refuge manager in 1947.

In 1946, the average daily catch was 23 bullheads per fisherman; in 1947, it was 16. On July 4, 1946, 2,500 fishermen were on the lake and, on May 30, 2,000. Nearly 7,000 fished during the 2 weeks of most intensive participation. The weekly average for the 28-week season in 1946 was 1,000-fisherman days. The total fisherman-days in 1947, as calculated by Harry L. Adams, was 38,000.

Rollings interviewed about 5 per cent of the fishermen in 1946 and found that the average daily individual expenditure for transportation, boat rental, bait, and other incidentals was $2.50. The cane-pole type of fishing is attractive to the majority of people, who do not travel so far or spend so much in reaching their fishing grounds as the bait-casting fishermen; 64 per cent of the Spring Lake fishermen traveled less than 25 miles. Other expenditures of the cane-pole fishermen are also less than those of the fishermen out after bass, crappies, or bluegills. The type of fishing at Spring Lake combined with the exceptionally high catch to give a public recreation value, table 4, not much above the actual meat value of the fish.

Fig. 5.--Commercial fishing is big business on many Illinois bottomland lakes bordering the Illinois and Mississippi rivers. The yield for several lakes in the Illinois River valley was calculated to average 141 pounds per acre.

Fig. 6.--Hoopnets or fykes are widely used as tackle by commercial fishermen in Illinois.

COMMERCIAL FISHERIES VALUE

Commercial fish -- carp, buffalo, catfish, bullheads, and sheepshead -- are a resource, figs. 5 and 6, of bottomland lakes almost as valuable in the public economy as are waterfowl. Studies made by aquatic biologists of the Illinois Natural History Survey indicate that bottomland lakes in the Illinois and Mississippi river valleys are capable of producing 200 to 300 pounds of fish per acre each year.

The harvest has, however, seldom equaled this amount, table 5, for regulations limiting the size and season, and prohibiting the taking of crappies, have been more restrictive than is believed necessary by some fisheries experts. It is to be anticipated that, with public acceptance of a need for more liberal fishing laws, regulations will be altered to permit a greater harvest of this resource.

Table 5.--Number of pounds of rough fish seined by commercial fishermen from Illinois River valley lakes, 1943-1947.

Area	Acres	Year	Pounds of Fish	Pounds Per Acre
Lake Senachwine.....	4,000	1945	800,000	200
Big Lake.....	950	1945	161,000	169
Big Lake.....	950	1946	151,000	159
Big Lake.....	950	1947	132,000	139
Anderson Lake.....	860	1947	62,000	72
Meredosia Bay.....	1,300	1943	144,416	111
Meredosia Bay.....	1,300	1944	212,524	164
Meredosia Bay.....	1,300	1945	122,500	94
Meredosia Bay.....	1,300	1946	133,163	102
Meredosia Bay.....	1,300	1947	84,715	65
Total.....	14,210	----	2,003,518	----
Average.....	----	----	-----	141

In our tabulations, we based the economic value of commercial fish on the actual poundage taken from those lakes for which records were available. Table 5 shows that an average catch of 141 pounds per acre-year was seined from the waters of four typical Illinois River bottomland lakes. This amounted to an average of $9.65 per acre each year at prices prevailing, 1943-1947, table 6.

No seining of fish has been permitted at the Chautauqua National Wildlife Refuge, but commercial fishermen were permitted to take rough fish in hoopnets on about 60 per cent of the

Table 6.--Commercial fisheries value of an acre of water in Illinois River valley lakes; figures based upon annual catch of 141 pounds per acre, 1943-1947.

Species	Per Cent of Catch	Pounds Per Acre	Wholesale Price Per Pound Undressed	Wholesale Value Per Acre
Carp.....	61.1	86.1	$0.04	$3.44
Buffalo.....	22.9	32.3	0.10	3.23
Catfish and bullhead.....	10.2	14.4	0.15	2.16
Sheepshead.....	5.8	8.2	0.10	0.82
Total.....	100.0	141.0	-----	$9.65

Table 7.--Number of pounds and value of various rough fish taken by commercial fishermen from hoopnets, Chautauqua National Wildlife Refuge, 1945-1947. *

Species	Pounds Per Acre				Value Per Acre
	1945	1946	1947	Average	
Carp	8.24	5.99	2.88	5.70	$0.23
Buffalo	14.44	3.90	3.72	7.35	0.73
Sheepshead	----	0.15	0.09	0.08	0.01
Catfish	0.09	0.12	0.14	0.12	0.02
Bullhead	0.13	0.05	----	0.06	0.01
Total	----	----	----	13.31	$1.00

* Commercial fishing permitted on only 60 per cent of refuge, but acreage figures prorated on basis of entire 3,200 acres of water.

lake. However, their reported catches, table 7, are prorated over the 3,200 acres of water in the lake. The value of the fish taken amounted to $1.00 per acre-year.

OTHER FISHERY VALUE

Commercial fishing was not permitted at the Spring Lake refuge, but both Lake Chautauqua and Spring Lake were used by the Illinois Department of Conservation for obtaining fish

Table 8.--Number of various species of fish taken from Chautauqua and Spring lakes by the Department of Conservation, and their value for restocking purposes.

Place	Kinds	Fish Per Acre				Value Per Fish	Value Per Acre
		1945	1946	1947	Average		
Lake Chautauqua	Largemouth bass	0.10	0.26	0.25	0.20	$0.75	$0.15
	Crappies	4.32	2.61	1.64	2.86	0.20	0.57
	Bluegill	1.00	1.12	1.23	1.12	0.30	0.34
	Other sunfish	--	0.18	0.06	0.08	0.10	0.01
	Yellow perch	--	0.15	--	0.05	0.10	0.00
	White and yellow bass	--	0.15	1.02	0.39	0.10	0.04
	Catfish	0.05	0.03	0.06	0.05	0.20	0.01
	Bullheads	0.22	0.19	0.23	0.21	0.15	0.03
	Others	0.12	0.20	0.57	0.29	0.10	0.03
	Total	5.81	4.99	5.06	5.25	--	$1.18
Spring Lake	Black bullheads	--	100.00	29.03	64.51	0.15	$9.68

for stocking new artificial lakes and farm ponds. These lakes proved superior to fish hatcheries as sources of fish because they supplied hardier fish of breeding age at less cost.

The number of the various species of fish taken per acre from Lake Chautauqua and Spring Lake by the Department of Conservation is given in table 8. Assigned values of fish for stocking purposes are based, in the case of bass, upon their sale price by private sources and, in the case of other fishes, upon their food value. The value of the stocking fish taken from Lake Chautauqua is only slightly above the cost of procurement to the Department of Conservation. The value of Lake Chautauqua to the state for obtaining stocking fish was calculated to be $1.18 per acre of water per year; of Spring Lake, $9.68 per acre-year.

Fig. 7.--Many marshes in Illinois return considerable revenue from the trapping of muskrats. The muskrat houses shown here are in a marsh smartweed bed, Rice Lake, near Banner.

FUR YIELD

The value of riverbottom lakes for muskrats, the principal furbearers, is regulated by the stability of water levels and the abundance of river bulrush *(Scirpus fluviatilis)*, marsh smartweed *(Polygonum muhlenbergi)*, fig. 7, and, to a much lesser extent, American lotus *(Nelumbium pentapetalum)* (Bellrose & Brown 1941). River bulrush and marsh smartweed occur on about 15 per cent of the water areas of the Illinois River valley and American lotus on an additional 10 per cent.

Enumeration of muskrat dwelling houses in the bottomland lakes of the Illinois River valley during the 1939-1940 and 1940-1941 trapping season, table 9, revealed averages of 0.34 and 0.35 house per acre of water area. Table 10 shows that at Rice and Chautauqua lakes the average number of muskrats trapped per house was 2.27. This number is comparable to the 2.9 and 2.6 muskrats trapped per house at the Sand Lake National Wildlife Refuge in South Dakota (Aldous 1947), but is much higher than the 0.67 to 1.10 trapped per house at the Blackwater National Wildlife Refuge in Maryland (Dozier *et al.* 1948).

Table 9.--Number of muskrat houses per acre on various areas in Illinois River valley during 1939-1940 and 1940-1941 trapping seasons.

Area	Acres in Lake Basin	Houses Per Acre	
		1939-40	1940-41
Goose Pond	1,500	0.15	0.32
Siebolt's Lake	420	0.05	---
Douglas Lake	1,800	0.22	0.94
Rice Lake	1,034	0.92	0.65
Big Lake	950	---	0.28
Goose Lake	726	---	0.11
Lake Chautauqua	3,200	0.35	0.20
Jake Lake	1,174	---	0.10
Ingram Lake	863	0.08	---
Cuba Island	1,072	0.26	---
Average	---	0.34	0.35

Table 10.--Number of muskrats trapped per house at Rice Lake and Lake Chautauqua, 1939-1941.

Lake	Season	Houses	Muskrats	Muskrats Per House
Rice	1939-40	954	1,497	1.57
Rice	1940-41	675	1,532	2.27
Chautauqua	1940-41	634	2,111	3.33
Average	-----	754	1,713	2.27

The number of muskrat houses per acre multiplied by the number trapped per house indicates a potential harvest of 0.78 muskrat per acre of water in Illinois River valley bottomland lakes. At 1944-1947 prices, which averaged $2.72 per pelt, the income from muskrats averaged $2.12 per acre. Minks and raccoons yielded an additional but relatively low return per acre.

TOTAL VALUES TO PUBLIC

Values for public hunting and fishing, for commercial fishing, and for fur trapping of a typical bottomland lake in the Illinois River valley are recapitulated in table 11. As determined from available sources, the value of an acre of bottomland lake at 1944-1947 prices is about $26 per year.

Table 11.--Per acre value to public of an average Illinois River bottomland lake; value based upon commercial fishing and fur trapping returns and expenditures by the public for duck hunting and angling, 1944-1947.

Source	Value Per Acre
Duck hunting	$12.18
Angling	2.40
Commercial fishing	9.65
Fur trapping	2.12
Total	$26.35

Spring Lake, near Savanna, is not typical of Illinois bottomland lakes in that it is a national wildlife refuge partly open to hunting, is not subject to overflow, and is north of converging waterfowl flyway routes. Consequently, its fish are its major resource; they had a yearly acre-value to the public of $34.24, 1946-1947, table 12. With duck hunting included, the total value of Spring Lake to the public in those years was $39.54 per acre.

Table 12.--Per acre value to public of Spring Lake, Savanna, Illinois; value based upon state fish restocking supply and expenditures by the public for duck hunting and angling.

Source	Value Per Acre
Duck hunting	$ 5.30
Angling	24.56
Fish restocking	9.68
Total	$39.54

RETURNS TO PRIVATE OWNERS

We have discussed fish and wildlife values to the public of riverbottom lakes in the Illinois and Mississippi river valleys of Illinois. What income would fish and wildlife bring to a private owner of these lands? Most of the natural bottomlands of the Illinois River are owned by duck shooting clubs, or by individuals who lease their lands for waterfowl hunting; most of those along the Mississippi River are owned by the federal government after having been acquired in conjunction with the canalization of that river. Leveed agricultural lands in both river valleys are privately owned.

Table 13.--Income from rental or lease of duck-hunting rights on bottomland lakes in the Illinois River valley, 1937-1947.

Place	Acres	Average Yearly Amount	Amount Per Acre	Period Covered
Rice Lake.....	1,034	$2,114	$2.13	1937-1942
Quiver Lake.....	100	1,215	12.15	1944
Quiver Creek.....	5	1,030	206.00	1943-1945
Moscow Bay.....	200	1,800	9.00	1947
Miserable Lake.....	200	1,100	5.50	1943-1944
Lake Senachwine.....	80	2,000	25.00	1943-1944
Goose Pond.....	800	4,000	5.00	1946-1947
Total.....	2,419	$13,259	----	-----
Average.....	----	-----	$ 5.48	-----

Table 13, shows the income landowners have received from the rental or lease of waterfowl hunting rights on various Illinois River valley areas. The average annual revenue was $5.48 per acre.

Some owners of bottomland waters do and some do not obtain revenue from the commercial fish taken from their property. Many duck club officials consider the fishing rights in the salary compensation of their caretakers and other personnel. Some charge a flat fee of several dollars per acre for commercial fishing rights. Other lake owners receive cash for half of the catch. The owner who conducted his own fishing operations grossed about $9.65 per acre annually, table 6, in the period 1943-1947.

Lake property owners along the Illinois and Mississippi rivers realize considerable income from the rental of boats to anglers, as indicated by table 14. Income listed in this table is derived from renting boats at the rate of $1.00 per day at Rice Lake and Lake Chautauqua in the Illinois River valley and at Spring Lake in the Mississippi River valley. The lack of income

in 1941 at Rice Lake was occasioned by low water. No records are available for Lake Chautauqua in 1944, or for Spring Lake before 1946. We have an additional record from a boat livery on 900-acre Beebe Lake, adjacent to Rice Lake, which shows an income of $3.32 per acre in 1944.

Table 14.--Income per acre from rental of boats to anglers on three bottomland lakes in Illinois, 1941-1947.

Lake	Acres	Income Per Acre							Average
		1941	1942	1943	1944	1945	1946	1947	
Chautauqua.....	3,200	$1.39	0.82	0.57	?	0.60	0.37	0.50	$0.77
Rice.....	1,034 1,167	0.00	0.31	1.20	0.80	1.65	2.22	3.86	$1.43
Spring.....	3,500	?	?	?	?	?	3.86	4.00	$3.93

These records of boat rentals reveal that owners of boat liveries may gross from $0.77 to almost $4.00 per acre annually; the amount is dependent on fishing success, accessibility to good roads, and size of the body of water. The average amount derived from combining all years and places for which figures were available was $1.32. Rental of cabins to anglers would provide a large source of income, but this facility is developed in the Illinois River valley only at Lake Senachwine near Putnam, Matanzas Lake near Havana, and Snicarte Slough near Bath. However, numerous private cabins or cottages have been built along the shores of seven Illinois River valley lakes and along the Mississippi River.

Many landowners, including the United States Fish and Wildlife Service and the Illinois Department of Conservation, receive half of the fur trapped on their property. The gross fur returns from bottomland lakes and marshes in Illinois bordering the Illinois and Mississippi amounted to about $2.12 per acre, 1944-1947.

Table 15.--Gross income per year that private owners of bottomland water areas in Illinois can expect to receive from fish and wildlife resources at 1944-1947 prices.

Source	Value Per Acre
Duck hunting.....	$ 5.48
Commercial fish.....	9.65
Boat rentals to anglers.....	1.32
Fur pelts.....	2.12
Total.....	$18.57

Table 15 recapitulates the calculated annual gross income of $18.57 per acre that owners of Illinois bottomland water areas can expect to receive from fish and wildlife resources at 1944-1947 prices. Further development in management of the bottomland water areas would undoubtedly increase the returns.

SUMMARY

1. Extensive areas of the Illinois and Mississippi river bottomlands have been drained and leveed, destroying fish and aquatic wildlife habitat and increasing flood heights.

2. Many groups of people in Illinois are questioning the wisdom of spending public funds to build, maintain, and improve levees to perpetuate an uncertain agricultural economy in areas in which restored bottomland would furnish significant revenue from fish and wildlife resources and would reduce flood heights.

3. The economic value of the fish and wildlife resources of bottomland lakes in Illinois was determined on the basis of the harvest of fish, fur, and ducks from various lakes, especially Spring Lake, near Savanna, and Lake Chautauqua, near Havana. These are national wildlife refuges that were formerly drainage and levee districts.

4. Public fish and wildlife values were appraised by determining amounts involved in the direct sale of commercial species and in the cost of hunting and fishing for the game species. Private values were calculated by determining the amounts involved in the lease of hunting rights, the rental of boats, cabins, and the like, and the income from commercial fish or fur taken.

5. Bottomland lakes in the Illinois River valley were calculated to have an annual per-acre value to the public, 1944-1947, of $26.35, made up as follows: duck hunting $12.18; angling $2.40; commercial fishing $9.65; and fur trapping $2.12.

6. Spring Lake, an abandoned levee district along the Mississippi River near Savanna, Illinois, was calculated to have an annual per-acre value to the public, 1946-1947, of $39.54, made up as follows: duck hunting $5.30; angling $24.56; and fish for restocking $9.68.

7. Privately owned lakes in the Illinois River valley were estimated to be capable of producing an average yearly gross return to owners, 1944-1947, of $18.57 per acre. Under improved management of the habitat and the harvest, these areas could produce a higher income.

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